(19) JAPANESE PATENT OFFICE (JP)

(12) PUBLICATION OF UNEXAMINED PATENT APPLICATION (A)

(11) Patent Application Disclosure (Kokai) Number: Hei 5-78945

(43) Date of Disclosure: March 30, 1993

(51) Int. Cl.[5]		Identif. Symbol	Intra-Office File Number	FI	Technology Indication
D 03 D	1/00	Z	7199-3B		
	15/12	A	7199-3B		

Number of Claims: 2 (Total of 5 pages)
Request for Examination: not yet requested

(21) Application Number: Hei 3-87232

(22) Filing Date: March 28, 1991

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(54) Name of the Invention: GLASS FIBER WOVEN FABRIC FOR PRINTED CIRCUIT BOARDS

(57) (Summary)

(Purpose)

The purpose of this invention is to obtain a glass fiber woven fabric for printed circuit boards, enabling to produce prepreg which has few pinholes or voids, and which has an excellent resin impregnating ability.

(Construction)

The glass fiber woven fabric uses a glass woven fabric with a total of 40 driving counts per 25 mm of vertical yarn (warp) and horizontal yarn (weft), and a glass fiber with a unit weight

of at least 180 g/m^2 characterized by air permeability of no more than 50 cm^3 / cm^2 /sec, or with a total of 60 driving counts per 25 mm of vertical yarn and horizontal yarn, using a unit weight at least 100 g/m^2 and no more than 180 g/m^2, and with air permeability of no more than 80 cm^3/cm^2/sec.

[see figure]

(Scope of the Patent's Claim)

(Claim 1)

A glass fiber woven fabric, characterized by the fact that a glass woven fabric has a total of 40 driving counts per 25 mm of vertical yarn (warp) and horizontal yarn (weft), using a glass fiber with a unit weight of at least 180 g/m^2 and with air permeability of no more than 50 cm^3/cm^2 /sec.

(Claim 2)

A glass fiber woven fabric, characterized by the fact that a glass woven fabric has a total of 60 driving counts per 25 mm of vertical yarn and horizontal yarn, using a unit weight at least 100 g/m^2 and no more than 180 g/m^2, and with air permeability of no more than 80 cm^3/cm^2/sec.

(Detailed Explanation of the Invention)

(0001)

(Sphere of Industrial Use)

This invention relates to a glass fiber woven fabric which can be used for printed circuit boards, in particular a glass fiber woven fabric which can be manufactured at a low cost and which enables to obtain prepreg having few pin holes.

(0002)

(Prior Art Technology)

Different types of printed circuit boards are manufactured depending on the type of the construction elements which are used in these boards. A glass fiber woven fabric is used as base material in these boards because this material has excellent electric characteristics as well as excellent mechanical characteristics, a superior heat resistance and other advantages, which is why it is often used in different types of electrical devices. Although there are different types of glass fiber woven fabrics, not that many types of glass fiber woven fabrics are being used at present in printed circuit boards. Particularly large amounts are used at present in printed circuit

boards in case of the universal type of boards belonging to type 7628 which is determined by MIL standards (MIL spec. Y-1140H), and in case of boards of type 2116, belonging to the same type of multi-layered boards. Table 1 indicates the specifications for this type of woven fabric.

(0003)

(Table 1)

	Textile Yarn Number Count of Used Yarn	Driving Count (Fibers/25 mm)	Weight (g/m^2)
type 2116	22.5 x 22.5	59 x 56	106
type 7628	67.5 x 67.5	43 x 33	208

(0004)

The requirement to bring the cost down, which is strongly emphasized in the printed board manufacturing industry, has lead to an examination of different types of measures aimed at cost reductions. From the viewpoint of the raw materials, for example, it is possible either to add a filling agent to a matrix resin, or it is also possible to use a glass fiber paper instead of a glass fiber woven fabric, etc., for this purpose. One of the measures aimed at bringing the cost down is a procedure according to which a thicker woven fabric is used in the glass fiber woven fabric. Generally, the universal type of printed circuit boards uses laminated layers of copper foils and 8 prepreg sheets with the 7628 type of glass fiber woven fabric. This is then processed in a heat press in order to obtain a printed circuit board with a thickness of 1.6 mm. If in this case, a glass fiber woven fabric which has a higher count of glass fibers is used instead of the glass fiber woven fabric of type 7628, this makes it possible to reduce the number of sheets used in the laminated layers of the prepreg from 8 sheets to 6 sheets or to 5 sheets. Because a thicker woven fabric is normally preferable when used for a glass fiber woven fabric, the cost of the raw materials used in the whole structure of the woven product plays a role in the cost of the product regardless of the relative importance of the weight of the fiber and of the unit cost per m^2. Accordingly, when a thicker glass fiber woven fabric is used, this brings down the cost of the raw materials in the woven fabric and when the number of the prepreg plies is reduced, the resulting effect is a lower cost of the laminated layers, which makes it possible to reduce the cost of a printed circuit board.

(0005)

On the other hand, although it is possible to create a cheaper design of a printed circuit board by using a thicker glass fiber woven fiber, there are problems connected with the capacity of a printed circuit board which is obtained in this manner. For example, the impregnating capability of the resin on the fiber will be poor when a larger count of grass fibers is used. This impregnating capability of the resin will be particularly poor in the part in which vertical yarn intersects the horizontal yarn. In addition, when a higher (thicker) count of the yarn is used, the

weave texture of the woven fabric will be particularly conspicuous on the surface of the printed circuit board, which in itself is a problem because this results in a poor smoothness of the surface. Accordingly, although using a thicker glass fiber woven product is an effective method enabling to bring the cost down, the present situation is that this method has not been put to practical use due to problems related to the performance aspects. The same principle is applicable also to type 2116 which is used with multilayered boards. And since the requirement on performance aspects are even more stringent in case of multilayered boards, this makes the application of a similar method that much more difficult.

(0006)

(Task To Be Solved By This Invention)

The task which is to be solved by this invention is to obtain a glass fiber woven fabric for printed circuit boards which is not only cheaper than the glass fiber woven fabric product that is generally used for many types of products, such as the type 7628 or the type 2116, but which also displays a better performance in a printed circuit board obtained in this manner, so that the printed circuit board using this glass fiber woven fabric provides the same or better capability of the printed circuit board than the performance of printed circuit boards of the type 7628 or the type 2116.

(0007)

(Means To Achieve The Task)

In order to achieve the above mentioned task, this invention provides a glass fiber woven fabric for use in printed circuit boards which can be used instead of the glass fiber woven fabric type 7628, having a total of no more than 40 driving counts per 25 mm of vertical yarn and horizontal yarn, with a unit weight of no more than 180 g/m^2, and with an air permeability of no more than 50 $cm^3/cm^2/sec$. In addition, this invention provides a glass fiber woven fabric for use in printed circuit boards which can be used instead of the glass fiber woven fabric type 2116, having a total of no more than 60 driving counts per 25 mm of vertical yarn and horizontal yarn, with a unit weight of at least 100 g/m^2 and no more than 180 g/m^2, and with an air permeability of no more than 80 $cm^3/cm^2/sec$.

(0008)

When the glass fiber woven product of this invention is replacing the 7628 type of glass fiber woven product, it is possible to use for example a yarn which has double the count of the yarn number count of the fiber use for type 7628, with a total of nor more than 40 driving counts per 25 mm of vertical yarn and horizontal yarn. In addition, since the yarn is thicker when the unit weight is set to 200 g, which is approximately the same as the unit weight of type 7628, in addition to the problem which is known as poor resign impregnating capability, another problem is that since the total count is less than 40 driving counts for vertical and horizontal yarn, vertical

yarn 1 of the woven fiber is surrounded by horizontal yarn 2, creating a large surface area of eyelet part 3 as shown in Figure 1. Accordingly, this means that pinholes or voids, etc., can easily occur in eyelet part 3. The result is that when a similar type of prepreg is used in order to manufacture a circuit board, pin holes or voids can easily be created in the printed circuit board even if care is taken to prevent this.

(0009)

In order to solve this problem in accordance with the glass fiber woven fabric of this invention, weave opening processing is conducted after weaving to create a flattened design of the open weave with the vertical yarn in the structure of the woven fiber. This makes it possible to create a very small surface area of the eyelet part 3' which is surround by vertical yarn 1' and horizontal yarn 2' of the woven fiber as shown in Figure 2. As a result of that, the air permeability of the glass fiber woven fabric of this product is less than 50 $cm^3/cm^2/sec$, which corresponds to products of type 7628, or less than 80 $cm^3/cm^2/sec$, which corresponds to products of type 2116. Although different types of methods can be used for the weave opening processing of the woven fabric, the use of a high-pressure current processing device which was disclosed in Japanese Patent Application Number Sho 61-230900 is optimal for this purpose. When this device is used, pressurized water is sprayed with a pressure in the range of 30 kg/cm^2 ~ 150 cm^2, which makes it possible to conduct a homogenous weave opening processing along the entire surface of the woven fiber. Although this weave opening processing can be conducted immediately after weaving, it is preferable when it is conducted continuously with the surface treatment process.

(0010)

(Operation)

Because the glass fiber woven fabric of this invention can be used with a thicker yarn number count than the yarn of type 7628 or of type 2116 which are commonly used at present, this makes it possible to reduce the driving count horizontal yarn by 40% ~ 50%. Accordingly, the weaving efficiency is improved which makes it possible to bring the cost down. In addition, since the driving count of the vertical yarn can be also reduced to the same extent, the result is that the production efficiency of the warping beam of the vertical yarn can be improved, which also helps to bring the cost down.

Moreover, because weave opening processing is also applied to the glass fiber woven yarn of this invention, a flattened structure of an open weave construction comprising the warp and the weft is created by this. Accordingly, the surface area of they eyelet part is extremely small even though the driving count is smaller, and also the air permeability is set to a low constant level. Because of that, the glass fiber woven fabric of this invention has an excellent impregnating capability with a sufficiently open weave comprising the warp and the weft, while an optimal impregnation with a resin is enabled thanks to the flattened design of the fabric,

enabling easy impregnation with the resin also in the yarn intersecting part.

(0011)

Because the surface area of the eyelet is very small, this means that pinholes or voids, etc., are unlikely to be generated in this part. Therefore, when the glass fiber woven fabric of this invention is used with its thicker yarn number count, this provides for an optimal smoothness of the surface of the substrate when the fabric is used for a prepreg of a circuit wiring board thanks to its flattened design and thanks to the open weave of the yarn.

(0012)

(Embodiments)

(Embodiment 1)

A glass fiber woven fabric having a yarn number count of 135 tex (ECG 37 1/0) was used for the vertical yarn (warp) and for the horizontal yarn (weft) to obtain a glass fiber woven fabric woven with 21 yarns/25 mm for the driving count of the vertical yarn and 17 yarns/25 mm for the driving count of the horizontal yarn (unit weight = 206 g/m^2). After heating and deoiling was applied to this woven fabric according to a customary method, γ-glycidoxy propyl triemthoxy silane was used as a silane coupling agent for surface treatment. The deposit rate of the surface treatment agent was 0.1%. The glass fiber woven fabric which was subjected to surface treatment was also subjected to weave opening treatment with a high-pressure current processing device which was disclosed in Japanese Patent Application Number 61-230900. A high water pressure of 100 kg/cm^2 was used for this purpose. The glass fiber woven fabric which was treated by weave opening treatment was impregnated with an epoxy resin varnish having the G-10 composition and when prepreg was formed, measurements were conducted to indicate the presence or absence of pin holes and to measure the impregnating characteristics. The results are shown in Table 3. In addition, although the air permeability of this glass fiber woven fiber was 84.5 cm^3/cm^2/sec before the weave opening treatment was conducted, its air permeability after the weave opening treatment was 36.1 cm^3/cm^2/sec.

(0013)

Embodiment 2

A glass fiber woven fabric having a yarn number count of 44.5 tex (ECE 1101/0) was used for the vertical yarn (warp) and for the horizontal yarn (weft) to obtain a glass fiber woven fabric woven with 29 yarns/25 mm for the driving count of the vertical yarn and 28 yarns/25 mm for the driving count of the horizontal yarn (unit weight = 106 g/m^2). After heating and deoiling was applied to this woven fabric according to a customary method, γ-glycidoxy propyl triemthoxy silane was used as a silane coupling agent for surface treatment. The deposit rate of the surface treatment agent was 0.1%. The glass fiber woven fabric which was subjected to

surface treatment was also subjected to weave opening treatment with a high-pressure current processing device which was disclosed in Japanese Patent Application Number 61-23090. A high water pressure of 70 kg/cm^2 was used for this purpose. The glass fiber woven fabric which was treated by weave opening treatment was impregnated with an epoxy resin varnish having the G-10 composition and when prepreg was formed, measurements were conducted to indicate the presence or absence of pin holes and to measure the impregnating characteristics. The results are shown in Table 3. Although the air permeability of this glass fiber woven fiber was 118.2 $cm^3/cm^2/sec$ before the weave opening treatment was conducted, its air permeability after the weave opening treatment was 63.6 $cm^3/cm^2/sec$.

(0014)

(Comparative Example 1)

A glass fiber woven fabric having a yarn number count of 67.5 tex (ECG 75 1/0) was used for the vertical yarn (warp) and for the horizontal yarn (weft) to obtain a glass fiber woven fabric woven with 43 yarns/25 mm for the driving count of the vertical yarn and 33 yarns/25 mm for the driving count of the horizontal yarn (unit weight of type 7628 = 208 g/m^2). After heating and deoiling was applied to this woven fabric according to a customary method, γ-glycidoxy propyl triemthoxy silane was used as a silane coupling agent for surface treatment. The deposit rate of the surface treatment agent was 0.1%. The glass fiber woven fabric which was subjected to surface treatment was impregnated with an epoxy resin varnish having the G-10 composition and when prepreg was formed, measurements were conducted to indicate the presence or absence of pin holes and to measure the impregnating characteristics. The results are shown in Table 3

(0015)

(Comparative Example 2)

A glass fiber woven fabric having a yarn number count of 22.5 tex (ECE 225 1/0) was used for the vertical yarn (warp) and for the horizontal yarn (weft) to obtain a glass fiber woven fabric woven with 59 yarns/25 mm for the driving count of the vertical yarn and with 56 yarns/25 mm for the driving count of the horizontal yarn (unit weight of type 2116 = 107 g/m^2). After heating and deoiling was applied to this woven fabric according to a customary method, γ-glycidoxy propyl triemthoxy silane was used as a silane coupling agent for surface treatment. The deposit rate of the surface treatment agent was 0.1%. The glass fiber woven fabric which was subjected to surface treatment was impregnated with an epoxy resin varnish having the G-10 composition and when prepreg was formed, measurements were conducted to indicate the presence or absence of pin holes and to measure the impregnating characteristics. The results are shown in Table 3.

(0016)

Table 2 shows the specifications of the glass fiber woven fabrics in the above described embodiments and comparative examples.

(0017)

Table 2

	Used Yarn	Driving Count (Yarns/25 mm)	Unit Weight (g/m^2)
Warp Embodiment 1 Weft	ECG 37 1/0 ECG 37 1/0	21 17	206
Warp Embodiment 2 Weft	ECE 110 1/0 ECE 110 1/0	29 28	106
Warp Compar. Example 1 Weft	ECG 75 1/0 ECG 75 1/0	43 33	208
Warp Compar. Example 2 Weft	ECE 225 1/0 ECE 225 1/0	59 56	107

Comparative Example 1 - glass fiber woven fabric ECE 110 1/0 7 µm x 400 filaments.
Respective filaments in Comparative Example 2 - ECE 225 1/0 7 µm x 200 filaments,
- ECG 37 1/0 9 µm x 800 filaments,
- ECG 75 1/0 9 µm x 400 filaments.

(0018)

(Table 3)

Table 3

	Weaving Characteristics (hrs/100 mm)	Presence or Absence of Pin Holes	Impregnating Characteristics (No. of Items)	Air Permeability ($cm^3/cm^2/sec$)
Embodiment 1	2.2	none	3	36.1
Embodiment 2	5.2	none	5	63.6
Compar. Ex. 1	5.5	none	28	13.2
Compar. Ex. 2	10.3	none	32	45.5

The weaving characteristics were measured as the time required to produce 100 m of woven product, the impregnating characteristics were measured as the number of voids in the prepreg per 5 cm square, the air permeability was the measured value measured during the glass fiber woven fiber status.

The testing method was used according to JIS [Japanese Industrial Standard] L 1096 "Air Permeability Test".

(0019)

(Effect of the Invention)

Because the glass fiber woven fabric of this invention has the characteristics which are indicated in Table 3, its weaving characteristics are about twice as good as those of products belonging to type 7628 and type 2116 which were produced according to conventional methods. Since this enables a proportional reduction of the cost, and since the yarn which has been treated by weave opening treatment has a low air permeability which is below a constant value regardless of the fact that a thick yarn number count is used, this makes it possible to obtain prepreg which has fewer pin holes or voids than woven fabrics manufactured according to prior art.

The result of this is that this design makes it possible to provide an expensive printed circuit board which can offer the same or better performance than conventional products.

(Brief Explanation of Figures)

(Figure 1)

An enlarged view showing the surface of one embodiment of the glass fiber woven fiber of this invention before the weave opening treatment.

(Figure 2)

An enlarged view showing the surface of one embodiment of the glass fiber woven fiber of this invention.

(Explanation of Codes)

1 vertical yarn,
1' vertical yarn,
2 horizontal yarn,
2' horizontal yarn,
3 eyelet part,

3' eyelet part.

[Figure 1]

[Figure 2]

(19)日本国特許庁（ＪＰ）　(12)**公開特許公報**（Ａ）　(11)特許出願公開番号

特開平5－78945

(43)公開日　平成５年(1993)３月30日

(51)Int.Cl.[5]	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｄ０３Ｄ　1/00		Ｚ　7199－3B		
15/12		Ａ　7199－3B		

審査請求　未請求　請求項の数２(全　５　頁)

(21)出願番号　特願平3－87232

(22)出願日　平成３年(1991)３月28日

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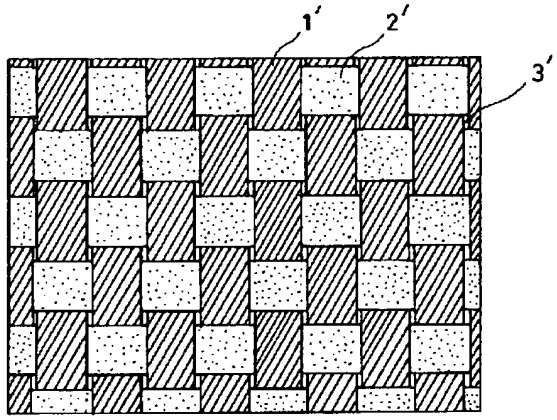
(54)【発明の名称】　プリント配線基板用ガラス繊維織物

(57)【要約】

【目的】　安価で、樹脂に対する含浸性に優れ、ピンホールやボイドの少ないプリプレグを得ることが可能なプリント配線基板用ガラス繊維織物を得ることを目的とする。

【構成】　たて糸とよこ糸の２５㎜当たりの打込本数の和が４０本以下であり、単重が１８０ｇ／m^2 以上で、通気度が５０cm^3 ／cm^2 ／ｓｅｃ以下であるガラス繊維織物、又は、たて糸とよこ糸の２５㎜当たりの打込本数の和が６０本以下であり、単重が１００ｇ／m^2 以上，１８０ｇ／m^2 未満であり、通気度が８０cm^3 ／cm^2 ／ｓｅｃ以下であるガラス繊維織物。



【特許請求の範囲】

【請求項１】　たて糸とよこ糸の２５mm当たりの打ち込み本数の和が４０本以下であり、単重が１８０g／m^2 以上であり、通気度が５０cm^3 ／cm^2 ／sec以下であることを特徴とするガラス繊維織物。

【請求項２】　たて糸とよこ糸の２５mm当たりの打ち込み本数の和が６０本以下であり、単重が１００g／m^2 以上，１８０g／m^2 未満であり、通気度が８０cm^3 ／cm^2 ／sec以下であることを特徴とするガラス繊維織物。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、プリント配線基板用ガラス繊維織物に関し、特に製織コストが安く、且つピンホールの少ないプリプレグを得ることができるガラス繊維織物に関するものである。

【０００２】

【従来の技術】プリント配線基板は、その構成材の種類により各種のものが製造されているが、その中でガラス繊維織物を基材とするものが電気特性や機械特性、耐熱性などの点で優れているため各種電子器機に多用されている。ガラス繊維織物もいろんな種類のものがあるが、現状プリント配線基板用として使用されているガラス繊維織物の種類はそれ程多くない。特に、プリント配線基板用として現在使用量の多いものは、汎用板の場合はＭＩＬ規格（ＭＩＬ　ｓｐｅｃ　Ｙ－１１４０Ｈ）に決められている７６２８タイプ、多層板の場合は同様に２１１６タイプに属するものである。表１に両方のタイプの織物の仕様を示す。

【０００３】

【表１】

	使用糸のテックス番手	打込本数（本／25mm）	単重（g/m^2）
2116タイプ	22.5×22.5	59×56	106
7628タイプ	67.5×67.5	43×33	208

【０００４】プリント基板業界においてもコストダウンの要求は強くコストダウンについての各種方策が検討されている。原材料面でいえば、例えば、マトリックス樹脂に充填剤を添加するとか、ガラス繊維織物の代わりにガラス繊維ペーパーを用いるなどである。これらコストダウンの方策の一つとして、ガラス繊維織物をより厚手の織物にするという手段がある。一般に汎用のプリント配線基板は、７６２８タイプのガラス繊維織物のプリプレグ８枚と銅箔を積層し、加熱プレスして１．６mm厚さのプリント配線基板を得ている。この場合、７６２８タイプのガラス繊維織物の代わりにより太番手のガラス繊維糸を用いたガラス繊維織物を使用すると、プリプレグの積層枚数を８枚から６または５枚に減らすことができる。ガラス繊維織物の場合、織物の単重とm^2 当たりの単価は比例関係に無く、通常はより厚手の織物を用いたほうが織物全体の原料コストは割安になる。従って、より厚手のガラス繊維織物を使用することにより、織物の原料コストが安くなること、及び、プリプレグのプライ数が減ることによる積層コストの低下の効果によりプリント配線基板のコストダウンが可能になる。

【０００５】しかし、厚手のガラス繊維織物を使用することによりプリント配線基板のコストダウンは計れるが、得られたプリント配線基板は性能の点で問題がある。例えば、太番手のガラス繊維糸を使用することにより、織物への樹脂の含浸が悪くなる。特に、たて糸とよこ糸の交点部分に対する樹脂の含浸が悪くなる。又、太番手の糸を使うことにより、プリント配線基板の表面に織物の織り目がはっきり出ることになり、それだけ、表面平滑性が悪くなるといつた問題である。従って、厚手のガラス繊維織物を使用することは、コストダウンには効果があるが性能面で問題があるため実用化されていないのが実情である。このことは多層板用の２１１６タイプの場合も同様で、多層板の場合は、性能面での要求が更に厳しいためこの様な方策をとることが一層難しい。

【０００６】

【発明が解決しょうとする課題】本発明が解決しょうとする課題は、プリント配線基板用のガラス繊維織物であって、一般に多用されている７６２８タイプや２１１６タイプよりも安価で、且つ、得られたプリント配線基板の性能が７６２８タイプや２１１６タイプで得られたプリント配線基板の性能と同等かそれ以上となるようなプリント配線基板用ガラス繊維織物を得ることにある。

【０００７】

【課題を解決するための手段】本発明は、上記課題を解決するために、たて糸とよこ糸の２５mm当たりの打ち込み本数の和が４０本以下で、単重が１８０g／m^2 以上であり、通気度が５０cm^3 ／cm^2／sec以下であるガラス繊維織物により７６２８タイプに代わり得る

プリント配線基板用ガラス繊維織物を得ようとするものであり、また、たて糸とよこ糸の２５ｍｍ当たりの打ち込み本数の和が６０本以下で、単重が１００ｇ／m^2 以上，１８０ｇ／m^2 未満であり、通気度が８０cm^3 ／cm^2 ／ｓｅｃ以下であるガラス繊維織物により２１１６タイプに代わり得るプリント配線基板用ガラス繊維織物を得ようとするものである。

【０００８】本発明のガラス繊維織物のうち、７６２８タイプに代わり得るガラス繊維織物の場合、例えば、使用糸としてテックス番手が７６２８タイプの２倍の番手を有する糸を用い、たて糸とよこ糸の２５ｍｍ当たりの打ち込み本数の和を４０本以下とし、且つ、単重を７６２８タイプと同じ２００ｇ前後に設定すると、糸が太くなるために樹脂の含浸が悪くなるといった前記した問題のほかに、たて，よこの打ち込み本数の和を４０本以下としているために、図１に示すように、織物のたて糸１とよこ糸２に囲まれた目開き部分３の面積が大きく、従って、このガラス繊維織物をプリプレグとした場合、目開き部分にピンホールやボイドが発生しやすい。この様なプリプレグを使ってプリント配線基板を製造すると、どうしてもボイドを含んだプリント配線基板になりやすい。

【０００９】本発明のガラス繊維織物は、この様な問題を解消するために、製織後開繊処理を行い、織物を構成するたて糸よこ糸を開繊し偏平化することにより、図２に示すように織物のたて糸１’とよこ糸２’に囲まれた目開き部分３’の面積を非常に小さくしたものである。その結果として、本発明のガラス繊維織物の通気度は、

７６２８タイプ相当の場合は　５０cm^3 ／cm^2 ／ｓｅｃ以下

２１１６タイプ相当の場合は　８０cm^3 ／cm^2 ／ｓｅｃ以下

である。織物の開繊処理の方法としては、各種方法が提案されているが特開昭６１－２３０９００号公報に開示されている高圧流体加工装置を利用するのが好ましい。この装置を利用し、高圧水の圧力を３０ｋｇ／cm^2 ～１５０ｋｇ／cm^2 の範囲で噴射することにより、織物全面にわたりほぼ均一な開繊処理を行うことができる。この開繊処理は、製織後直ちに行うことも可能であるが、出来れば、表面処理後表面処理工程と連続して行うことが望ましい。

【００１０】

【作用】本発明のガラス繊維織物は、現在一般に使用されている７６２８タイプや２１１６タイプに対し、それぞれ太番手の糸を使用することができるため、よこ糸の打ち込み本数を４０％～５０％少なくすることができる。従って製織効率が向上しコストダウンが可能となる。また、たて糸の打ち込み本数もよこ糸と同じ程度少なくすることができ、その結果、たて糸整経ビームの生産効率を上げることができ、この事によってもコストダウンが可能になる。又、本発明のガラス繊維織物は、開繊処理されているため織物を構成しているたて糸よこ糸が開繊され偏平になっている。従って、打ち込み本数が少ないにも拘らず目開き部分の面積が非常に小さく、通気度も一定の値以下となっている。この様に、本発明のガラス繊維織物は、たて糸よこ糸が十分に開繊され、且つ、偏平化されているため樹脂の含浸性が良く、糸の交点部分にも樹脂が含浸されやすい。

【００１１】目開き部分の面積が非常に小さいためプリプレグとした場合、その部分にピンホールやボイドが発生しにくい。本発明のガラス繊維織物は、太番手の糸を使用するが、糸が開繊され、偏平化されているために、プリント配線基板とした場合、基板表面の平滑性は良好である。

【００１２】

【実施例】

実施例１

番手が１３５ｔｅｘのガラス繊維糸（ＥＣＧ３７　１／０）をたて糸よこ糸とし、打ち込み本数　たて　２１本／２５ｍｍ　よこ　１７本／２５ｍｍで製織しガラス繊維織物を得た（単重　２０６ｇ／m^2 ）。この織物を常法により加熱脱油したのち、シランカップリング剤としてγ－グリシドキシプロピルトリメトキシシランを用い表面処理を行った。表面処理剤の付着率は０．１％であった。表面処理されたガラス繊維織物を特開昭６１－２３０９００号公報に開示されている高圧流体加工装置により開繊処理を行った。用いた高圧水の圧力は１００ｋｇ／cm^2 であった。開繊処理されたガラス繊維織物をＧ－１０組成のエポキシ樹脂ワニスに含浸しプリプレグを作成し、ピンホールの有無、および、含浸性を測定した。結果を表３に示す。又、開繊処理前のこのガラス繊維織物の通気度は、８４．５cm^3 / cm^2 / secであったが、開繊処理後の通気度は、３６．１cm^3 / cm^2 /secであった。

【００１３】実施例２

番手が４４．５ｔｅｘのガラス繊維糸（ＥＣＥ１１０　１／０）をたて糸よこ糸とし、打ち込み本数　たて　２９本／２５ｍｍ　よこ　２８本／２５ｍｍで製織しガラス繊維織物を得た（単重　１０６ｇ／m^2 ）。この織物を常法により加熱脱油したのち、シランカップリング剤としてγ－グリシドキシプロピルトリメトキシシランを用い表面処理を行った。表面処理剤の付着率は０．１％であった。表面処理されたガラス繊維織物を特開昭６１－２３０９００号公報に開示されている高圧流体加工装置により開繊処理を行った。用いた高圧水の圧力は７０ｋｇ／cm^2 であった。開繊処理されたガラス繊維織物をＧ－１０組成のエポキシ樹脂ワニスに含浸しプリプレグを作成し、ピンホールの有無、および、含浸性を測定した。結果を表３に示す。開繊処理前のこのガラス繊維織物の通気度は１１８．２cm^3 / cm^2 /secであった

が、開繊処理後の通気度は６３．６cm^3 / cm^2/secであった。

【００１４】比較例１

番手が６７．５ｔｅｘのガラス繊維糸（ＥＣＧ７５　１／０）をたて糸よこ糸とし、打ち込み本数　たて　４３本／２５ｍｍ　よこ　３３本／２５ｍｍで製織しガラス繊維織物を得た（７６２８タイプ　単重　２０８ｇ／m^2）。この織物を常法により加熱脱油したのち、シランカップリング剤としてγ－グリシドキシプロピルトリメトキシシランを用い表面処理を行った。表面処理剤の付着率は０．１％であった。表面処理されたガラス繊維織物をＧ－１０組成のエポキシ樹脂ワニスに含浸しプリプレグを作成し、ピンホールの有無、および、含浸性を測定した。結果を表３に示す。

【００１５】比較例２

番手が２２．５ｔｅｘのガラス繊維糸（ＥＣＥ２２５　１／０）をたて糸よこ糸とし、打ち込み本数　たて　５９本／２５ｍｍ　よこ　５６本／２５ｍｍで製織しガラス繊維織物を得た（２１１６タイプ　単重　１０７ｇ／m^2）。この織物を常法により加熱脱油したのち、シランカップリング剤としてγ－グリシドキシプロピルトリメトキシシランを用い表面処理を行った。表面処理剤の付着率は０．１％であった。表面処理されたガラス繊維織物をＧ－１０組成のエポキシ樹脂ワニスに含浸しプリプレグを作成し、ピンホールの有無、および、含浸性を測定した。結果を表３に示す。

【００１６】前記実施例および比較例のガラス繊維織物の仕様を表２に示す。

【００１７】

【表２】

	使　用　糸	打込本数（本/25㎜）	単重（g/㎡）
実施例１ たて	ＥＣＧ３７　１／０	２１	２０６
実施例１ よこ	ＥＣＧ３７　１／０	１７	
実施例２ たて	ＥＣＥ１１０　１／０	２９	１０６
実施例２ よこ	ＥＣＥ１１０　１／０	２８	
比較例１ たて	ＥＣＧ７５　１／０	４３	２０８
比較例１ よこ	ＥＣＧ７５　１／０	３３	
比較例２ たて	ＥＣＥ２２５　１／０	５９	１０７
比較例２ よこ	ＥＣＥ２２５　１／０	５６	

比較例１は７６２８タイプのガラス繊維織物

比較例２は２１１６タイプのガラス繊維織物

各使用糸のフィラメント構成は

ＥＣＧ３７　１／０　　９μｍ×８００フィラメント

ＥＣＧ７５　１／０　　９μｍ×４００フィラメント

ＥＣＥ１１０　１／０　　７μｍ×４００フィラメント

ＥＣＥ２２５　１／０　　７μｍ×２００フィラメント

【００１８】

【表３】

	製織性 (hrs/100m)	ピンホールの有無	含浸性 (個数)	通気度 ($cm^3/cm^2/sec$)
実施例1	2．2	なし	3	36．1
実施例2	5．2	なし	5	63．6
比較例1	5．5	なし	28	13．2
比較例2	10．3	なし	32	45．5

製織性は１００m織り揚げるのに要する時間
含浸性は５ｃｍ角のプリプレグにおけるボイドの数
通気度はガラス繊維織物の状態での測定値。
試験法はＪＩＳ　Ｌ　１０９６　「通気性試験」による。

【００１９】

【発明の効果】本発明のガラス繊維織物は表３に示すように、製織性は従来の７６２８タイプ、及び、２１１６タイプと比較して約2倍になっており、その分コストダウンが可能であり、又、太番手の糸を使用しているにも拘らず、糸が開繊されて織物の通気度が一定の値以下になっているため、従来の織物と比較してピンホールやボイドの少ないプリプレグを得ることができる。その結果、従来と同等かそれ以上の性能を維持しながら、コストの安いプリント配線基板を得ることが可能である。

【図面の簡単な説明】

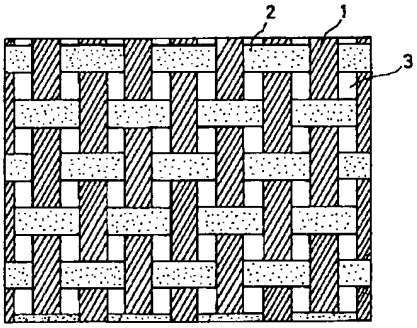
【図１】本発明ガラス繊維織物の一実施例の開繊処理前の表面拡大図

【図２】本発明ガラス繊維織物の一実施例の表面拡大図

【符号の説明】

1　たて糸
1’　たて糸
2　よこ糸
2’　よこ糸
3　目開き部分
3’　目開き部分

【図１】



【図２】